

**PROPOSED AMENDMENTS TO THE WATER QUALITY CONTROL PLAN FOR
THE SACRAMENTO RIVER AND SAN JOAQUIN RIVER BASINS
FOR THE CONTROL OF MERCURY IN CACHE CREEK, BEAR CREEK, SULPHUR
CREEK, AND HARLEY GULCH (COLUSA, LAKE, AND YOLO COUNTIES)**

Staff Report Summary

Central Valley Regional Water Quality Control Board staff has prepared a report that describes a proposal to amend the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins to address the regulation of mercury in Cache, Bear, and Sulphur Creeks and Harley Gulch (Lake, Colusa, and Yolo Counties). Major components of the proposed amendments are:

- Addition of a beneficial use designation of commercial and/or sport fishing (COMM) for Cache and Bear Creeks and the removal of the municipal and domestic supply (MUN) designation for Sulphur Creek;
- Numeric objectives for methylmercury in fish tissue that are site-specific to Cache Creek, Bear Creek, and Harley Gulch;
- An implementation plan for controlling methylmercury and mercury loads; and
- A surveillance and monitoring program.

The staff report describes how these proposed amendments were selected from various alternatives that were evaluated.

Cache, Bear, and Sulphur Creeks and Harley Gulch are on the Clean Water Act 303(d) List of Impaired Water Bodies because of elevated levels of mercury in water and sediment. In addition, levels of mercury in fish in Cache and Bear Creeks exceed the USEPA recommended criterion for the protection of human health. The goal of the proposed Basin Plan amendments is to lower mercury levels in these water bodies so that the beneficial uses of fishing and wildlife habitat are attained.

Proposed Modifications to Basin Plan Chapter II (Existing and Potential Beneficial Uses) Staff proposes addition of the COMM beneficial use for Cache and Bear Creeks. The sport fishery in Cache and Bear Creeks is moderately used. There is no commercial fishing currently or intended on either creek. Staff also proposes to remove MUN for Sulphur Creek due to naturally occurring, elevated levels of total dissolved solids and mercury.

Proposed Modifications to Basin Plan Chapter III (Water Quality Objectives) Staff proposes site-specific, numeric objectives of methylmercury in fish tissue for Cache and Bear Creeks and Harley Gulch. No objective is proposed for Sulphur Creek because it does not support fish. Methylmercury is the most toxic form of mercury and accumulates in successive levels of the food chain. It is a neurotoxicant that adversely affects reproductive and immune systems in humans and wildlife that consume fish.

Nearly all methylmercury is acquired through consumption of mercury contaminated fish and shellfish. Staff considered three alternatives for the methylmercury numeric objectives:

1. **Objective Alternative 1 - No Action.** This alternative is for continued application of the Basin Plan's narrative objective for toxicity. This alternative does not set a numeric limit for the concentration of methylmercury in fish tissue.
2. **Objective Alternative 2.** This alternative proposes numeric objectives based on protection of sensitive wildlife species and human health. For Cache and Bear Creeks, objectives are 0.23 mg methylmercury/kg fish in trophic level 4 fish (piscivorous species including bass and catfish) and 0.12 mg/kg in trophic level 3 fish (bluegill, sunfish, and sucker). For Harley Gulch, the objective is 0.05 mg methylmercury/kg in small, resident fish (such as roach and hardhead less than 4 inches in length).
3. **Objective Alternative 3.** This alternative evaluates objectives based on the USEPA's recommended methylmercury criterion for the protection of human health. For Cache and Bear Creeks, objectives are 0.3 mg/kg, wet weight in trophic level 4 fish and 0.15 mg/kg in trophic level 3 fish. Because humans do not consume the small fish in Harley Gulch, Alternative 3 is not applicable there.

The preliminary staff recommendation is adoption of Objective Alternative 2. These objectives will protect local threatened and endangered species, including bald eagles. Attainment of these objectives would allow humans to safely consume 22-40 g/day (3-5 meals/month) of Cache and Bear Creek fish, depending upon size and species of local fish and intake of commercial fish. This range is slightly more than the USEPA default consumption rate (17.5 g/day).

Proposed Modifications to Basin Plan Chapter IV (Implementation)

Staff proposes a strategy to reduce mercury and methylmercury loads in Cache, Bear, and Sulphur Creeks and Harley Gulch. The strategy includes load allocations and aqueous methylmercury implementation goals linked to the fish tissue objectives. The mercury source information is summarized in the TMDL reports and below:

Cache Creek

In Cache Creek, the watershed above Rumsey was the major source of methylmercury. The highest concentrations and production rates were observed below the mercury mines in Harley Gulch, Sulphur Creek, and Bear Creek and in the canyon above Rumsey. Lower aqueous methylmercury concentrations were measured in the North Fork and Cache Creek below the Clear Lake dam, which have lower inorganic mercury concentrations in sediment.

Sources of total mercury in Cache Creek largely parallel the sources of methylmercury. Most mercury derives from the watershed upstream of Rumsey. On a 5-year average,

mercury loads from the mine-related tributaries (Bear Creek, Harley Gulch, and Davis Creek), North Fork Cache Creek and Clear Lake contributed about 15 percent of the mercury loads measured in Cache Creek at Rumsey. The majority of the inorganic mercury loads were from unnamed sources, which include smaller, unmeasured tributaries and mercury in the Cache Creek streambed and banks. Sediment entering the watershed below Rumsey acts to dilute sediment mercury concentrations.

Bear Creek

The Bear Creek watershed upstream of all mine inputs contributes minimally to the loads of methylmercury and total mercury in Bear Creek. Sulphur Creek contributes about half of each of the methylmercury and total mercury loads in Bear Creek. The remainder of the Bear Creek methylmercury likely comes from production within the channel and seepage of underground springs. The rest of the mercury load in Bear Creek likely derives from the remobilization of mine waste deposited in the floodplain and geothermal springs.

Harley Gulch

Much of the methylmercury in Harley Gulch is likely produced in a wetland area in the West Branch Harley Gulch, downstream of the inactive mercury mines. Over ninety percent the total mercury load in Harley Gulch is estimated to come from the mine-impacted West Branch. Total mercury loads from the mines may be underestimated due to a lack of data collected during extreme rainfall events. An alluvial fan, possibly containing mine waste, at the Harley Gulch confluence with Cache Creek may contribute to the unnamed source of mercury in the Cache Creek canyon.

Sulphur Creek

Inactive mines in the upper Sulphur Creek watershed contribute an estimated 30% of the mercury load in the creek. Mine sites, contaminated stream sediment, and geothermal springs in the lower watershed contribute about 60% of the total mercury loads. The remaining 10% of loads are estimated to come from erosion of background soil and unidentified geothermal springs. Methylmercury is discharged from some geothermal springs and produced within the creek bed.

Implementation Alternatives

Staff evaluated three implementation alternatives to reduce mercury and methylmercury loads in the four water bodies and achieve the fish tissue objectives. To protect humans consuming fish, all of the implementation alternatives recommend public outreach regarding the levels of safe fish consumption and monitoring to assess progress toward the objectives. The implementation plan is based on studies that suggest production of methylmercury is positively correlated with levels of mercury in surficial sediment. Reducing total mercury loads will reduce concentrations of mercury in sediment and is expected to reduce subsequent methylmercury production. Therefore, most of the alternatives evaluated focus on reducing total mercury loads and reducing mercury sediment concentrations.

Implementation Alternative 1. No Action. For this alternative, no control actions would be required. This alternative relies completely on natural erosion and transport of contaminated sediment out of the system. Passive dilution of contaminated streambed sediments by cleaner, incoming sediment would occur after erosion from mine sites has ceased. With no active remediation, the water quality objectives are not expected to be achieved.

Implementation Alternative 2. Alternative 2 is a preliminary proposal for projects in the Cache Creek watershed to reduce the erosion and transport of mercury and generation of methylmercury. Actions to reduce mercury loads could include:

- Remediation at inactive mines including adjacent, contaminated stream banks,
- Control of erosion in mercury-enriched areas including grazing and road maintenance,
- Feasibility study and possible management of sediment behind the Capay inflatable dam,
- Feasibility studies to evaluate remediation options in Cache Creek in areas with elevated mercury concentrations, such as the Harley Gulch sediment delta, and
- Regional Board staff and landowner coordination to identify sites and possible projects to remediate contaminated floodplain sediment.

Actions evaluated to reduce methylmercury production include additional studies of sources and possible control in Bear Creek and Anderson Marsh; evaluation and minimization of methylmercury inputs from former gravel excavations; and prohibition of increases in methylmercury inputs from any new impoundments, wetlands restoration projects, or geothermal spring development.

Implementation Alternative 3. This Alternative includes all of the preliminary proposed actions in Alternative 2 and evaluates additional projects to further reduce mercury loads, including:

- Remediation of mine wastes not immediately adjacent to mines,
- Additional remediation or removal of contaminated sediment in Cache Creek Canyon and Bear and Sulphur Creeks,
- Selective remediation or removal of contaminated sediment in Cache Creek downstream of Rumsey,
- Treatment of geothermal springs,
- More stringent erosion control from grazing, road maintenance, firewood collection, and other anthropogenic activities, and
- Installation of small sediment basins downstream of mines, should mine cleanups prove financially or legally difficult.

The preliminary staff recommendation is to reduce mercury loading is through Implementation Alternative 2. Alternative 2 may provide the best balance between cost and time for improvement in fish tissue concentrations. Alternative 2 is expected to

reduce methylmercury loads in Cache Creek by 70 g/year and total mercury loads by at least 80 kg/year when fully implemented. Cost for full implementation is estimated between \$10 and \$16 million. Because of the large amount of mercury present in the creek beds and banks, it will likely take several decades to see a significant change in mercury levels in fish and possibly several hundred years until objectives are attained.

Water quality objectives are not expected to be attained under Implementation Alternative 1. Implementation Alternative 3 will likely decrease loads of total mercury more quickly and at a greater cost than Alternative 3. Estimated costs for Alternative 3 are \$50-120 million. As mercury repositories addressed in some projects in Alternative 3 are less concentrated than the mines (e.g., the stream bank downstream of Rumsey), costs are considerably higher than Alternative 2. Because of the quantity of mercury remaining in the Cache Creek canyon, however, fish tissue objectives may be attained only slightly sooner under Alternative 3.

Proposed Modifications to Basin Plan Chapter V (Surveillance and Monitoring)

Staff proposes a surveillance and monitoring program to ensure compliance with the objectives in Clear Lake. The program includes water, sediment, and fish tissue monitoring.

Environmental Analysis

To satisfy requirements of the California Environmental Quality Act, staff performed an environmental analysis of the potential impacts of the proposed Basin Plan amendments, including beneficial use addition, numeric water quality objectives, and implementation plan. The proposed amendments were found to have no significant adverse effects on the environment. Actions taken by entities to comply with the proposed Basin Plan amendments are expected to conduct site-specific environmental impacts.

The entire draft staff report is available at <http://www.waterboards.ca.gov/centralvalley/programs/tmdl/Cache-SulphurCreek/index.html>. Staff will circulate a revised report for public review and comment prior to a future Regional Board hearing.